THE PROCEEDINGS OF THE PHYSICAL SOCIETY

Section B

FROM JANUARY 1950 TO DECEMBER 1950

VOLUME 63

Published by
THE PHYSICAL SOCIETY
1 Lowther Gardens, Prince Consort Road,
London S.W.7

Y-12551

OFFICERS AND COUNCIL, 1950-51

53249

PRESIDENT

L. F. Bates, D.Sc., Ph.D., F.R.S.

VICE-PRESIDENTS
who have filled the Office of President

C. H. Lees, D.Sc., F.R.S. (1918–20)
Sir Frank Smith, G.C.B., G.B.E., D.Sc., LL.D., F.R.S. (1924–26)
Sir Owen Richardson, M.A., D.Sc., F.R.S. (1926–28)
W. H. Eccles, D.Sc., M.I.E.E., F.R.S. (1928–30)
A. O. Rankine, O.B.E., D.Sc., F.R.S. (1932–34)
T. Smith, M.A., F.R.S. (1936–38)
Allan Ferguson, M.A., D.Sc. (1938–41)
Sir Charles Darwin, K.B.E., M.C., M.A., Sc.D., F.R.S. (1941–43)
E. N. da C. Andrade, Ph.D., D.Sc., F.R.S. (1943–45)
Sir David Brunt, M.A., Sc.D., F.R.S. (1945–47)
G. I. Finch, M.B.E., D.Sc., F.R.S. (1947–49)
S. Chapman, M.A., D.Sc., F.R.S. (1949–50)

VICE-PRESIDENTS

W. Jevons, D.Sc., Ph.D.
C. H. Collie, M.A., B.Sc.
R. E. Peierls, C.B.E., M.A., D.Phil., D.Sc., F.R.S.
D. Roaf, M.A., D.Phil.

HONORARY SECRETARIES

C. G. Wynne, B.A. (*Business*)
H. H. Hopkins, Ph.D. (*Papers*)

HONORARY FOREIGN SECRETARY

E. N. da C. Andrade, Ph.D., D.Sc., F.R.S.

HONORARY TREASURER

A. J. Philpot, C.B.E., M.A., B.Sc.

HONORARY LIBRARIAN

R. W. B. Pearse, D.Sc., Ph.D.

ORDINARY MEMBERS OF COUNCIL

A. C. G. Menzies, M.A., D.Sc.
J. H. Awbery, M.A., B.Sc.
R. C. Evans, M.A., Ph.D.
L. C. Martin, D.Sc.
C. E. Wynn-Williams, D.Sc., Ph.D.
A. G. Quarrell, D.Sc., Ph.D.
A. B. Wood, O.B.E., D.Sc.
H. S. W. Massey, B.A., Ph.D., F.R.S.
L. J. Davies, M.A., B.Sc.
W. V. Mayneord, D.Sc.
R. W. B. Stephens, B.Sc., Ph.D.
S. Marsh, D.Sc., Ph.D.

COLOUR GROUP

Chairman
W. S. Stiles, O.B.E., D.Sc., Ph.D.

Honorary Secretary
R. G. Horner, B.A.

LOW-TEMPERATURE GROUP

Chairman
F. E. Simon, C.B.E., M.A., D.Phil., F.R.S.

Honorary Secretary
G. G. Haselden, Ph.D.

OPTICAL GROUP

Chairman
A. C. G. Menzies, M.A., D.Sc.

Honorary Secretary
K. J. Habell, M.Sc.

ACOUSTICS GROUP

Chairman
H. L. Kirke, C.B.E., M.I.E.E.

Joint Honorary Secretaries
W. A. Allen, B.Arch., A.R.I.B.A.
A. T. Pickles, O.B.E., M.A.

SECRETARY-EDITOR

Miss A. C. Stickland, M.Sc., Ph.D.
1 Lowther Gardens, Prince Consort Road, London S.W.7
(*Telephone* : KENsington 0048)

CONTENTS

Part 1. *January* 1950

PAGE

Editorial 1

Mr. J. K. MACKENZIE. The Elastic Constants of a Solid containing Spherical Holes 2

Prof. FRIEDRICH BLAHA. On Movements of Small Ferromagnetic Particles in Inhomogeneous Magnetic Fields 12

Mr. B. COLLINGE. Dead Times of Self-Quenching Counters 15

Mr. F. G. HEYMANN. Breakdown in Cold-Cathode Tubes at Low Pressure . 25

Mr. W. E. WILLSHAW and Mr. R. G. ROBERTSHAW. The Behaviour of Multiple Circuit Magnetrons in the Neighbourhood of the Critical Anode Voltage . 41

Mr. D. G. KIELY. Measurements of the Reflection Coefficient of Water at a Wavelength of 8·7 mm. 46

Mr. T. L. ECKERSLEY. Coupling of the Ordinary and Extraordinary Rays in the Ionosphere 49

Letters to the Editor:

Mr. A. N. HUNTER. The Debye Effect in Electrolytes 58

Mr. C. E. CHALLICE. Electron Optics of the Three-Stage Electron Microscope 59

Reviews of Books. 62

Contents for Section A 63

Abstracts for Section A 63

Part 2. *February* 1950

Dr. J. B. BIRKS. The Properties of Ferromagnetic Compounds at Centimetre Wavelengths 65

Dr. L. JACOB. The Field in an Electron-Optical Immersion Objective . . 75

Miss M. GILBERT. Colour Perception in Parafoveal Vision 83

Dr. D. BROMLEY and Dr. R. H. HERZ. Quantum Efficiency in Photographic X-ray Exposures 90

Mr. B. H. BRIGGS, Mr. G. J. PHILLIPS and Mr. D. H. SHINN. The Analysis of Observations on Spaced Receivers of the Fading of Radio Signals . . . 106

M. R. BUREAU. Les renforcements brusques des ondes très longues . . . 122

Dr. R. RIVAULT. Diffusion des échos au voisinage des fréquences critiques de F 2 . 126

Mr. D. R. BATES and Mr. M. J. SEATON. Theoretical Considerations Regarding the Formation of the Ionized Layers 129

Physical Society Conference at Cambridge—Abstracts 141

Reviews of Books 151

Contents for Section A 154

Abstracts for Section A 155

Part 3. *March* 1950

Dr. G. G. HASELDEN. The Deposition of Ice Crystals on Cooling Surfaces in Low Temperature Plant 157

Mr. T. S. MOSS. A Relationship between the Refractive Index and the Infra-Red Threshold of Sensitivity for Photoconductors 167

Dr. R. COOPER. Capacitance Measurements on Selenium Rectifiers: Evidence of Anomalous Dispersion 176

Mr. J. W. WARREN, Mr. W. HOPWOOD and Dr. J. D. CRAGGS. On Dissociation Processes in Certain Gases of High Dielectric Strength 180

PAGE

Dr. R. C. Parker and Mr. D. Hatch. The Static Coefficient of Friction and the Area of Contact 185
Prof. E. N. da C. Andrade and Dr. R. F. Y. Randall. The Thermal Etching of Single Crystals of Cadmium 198
Mr. H. D. Keith. The Lattice-Parameters of Clear Crystalline Quartz . . 208
Letters to the Editor:
Dr. J. Collard, Mr. G. R. Nicoll and Dr. A. W. Lines. Discrepancies in the Measurement of Microwave Power at Wavelengths below 3 cm. . . 215
Reviews of Books 216
Corrigenda 221
Contents for Section A 222
Abstracts for Section A 222

Part 4. *April* 1950

Prof. A. O. Rankine. Experimental Studies in Thermal Convection (33rd Guthrie Lecture) 225
Dr. G. M. B. Dobson. Physics and the Atmosphere (5th Charles Chree Address) 252
Mr. B. G. Childs and Mr. S. Weintroub. The Measurement of the Thermal Expansion of Single Crystals of Tin by an Interferometric Method . . 267
Dr. O. Buneman. A Toroidal Magnetron 278
Mr. C. N. Davies. Viscous Flow Transverse to a Circular Cylinder . . . 288
Mr. F. H. Krenz. On the Fluctuating Concentration of X-Ray Products in Water Dispersions 297
Dr. R. Fürth and Dr. D. K. C. MacDonald. On the Retarding Field Current in Diodes 300
Contents for Section A 303
Abstracts for Section A 303

Part 5. *May* 1950

Mr. G. Bradfield. Summarized Proceedings of Symposium on Applications of Ultrasonics 305
Mr. A. C. Lynch. Measurement of the Equivalent Electrical Circuit of a Piezoelectric Crystal 323
Dr. S. Harper and Prof. A. H. Cottrell. Surface Effects and the Plasticity of Zinc Crystals 331
Mr. H. L. Wain and Prof. A. H. Cottrell. Yield Points in Zinc Crystals . 339
Mr. L. M. T. Hopkin. A Simple Constant Stress Apparatus for Creep Testing. 346
Dr. G. L. J. Bailey and Mr. H. C. Watkins. Surface Tensions in the System Solid Copper–Molten Lead 350
Dr. K. M. Greenland and Mr. C. Billington. The Construction of Interference Filters for the Transmission of Light of Specified Wavelengths . . . 359
Mr. D. R. Barber. Note on the Brightness Profile and Photometric Contrast of a Test-object having small Angular Dimensions and Silhouetted against the Twilight Sky 364
Letters to the Editor:
Dr. R. F. Saxe and Dr. J. B. Higham. The Measurement of Spark Channel Diameters 370
Mr. H. A. Gebbie, Mr. P. C. Banbury and Dr. C. A. Hogarth. Crystal Diode and Triode Action in Lead Sulphide 371
Reviews of Books 372
Contents for Section A 373
Abstracts for Section A 374

Part 6. *June* 1950

PAGE

Dr. K. D. Froome. The Behaviour of the Cathode Spot on an Undisturbed Liquid Surface of Low Work Function 377
Dr. Mary B. Hesse. The Calculation of Magnetic Lens Fields by Relaxation Methods 386
Dr. D. J. Malan and Dr. B. F. J. Schonland. An Electrostatic Fluxmeter of Short Response-time for use in Studies of Transient Field-changes . . 402
Dr. G. G. Macfarlane and Mr. H. G. Hay. Wave Propagation in a Slipping Stream of Electrons: Small Amplitude Theory 409
Dr. J. A. Gledhill and Dr. M. E. Szendrei. Theory of the Production of an Ionized Layer in a Non-Isothermal Atmosphere Neglecting the Earth's Curvature, and its Application to Experimental Results 427
Mr. J. E. H. Braybon. A New Method of Measurement of the Variation with Wavelength of the Refractive Index and Absolute Stress Optical Coefficients of Amorphous Solids 446
Dr. Mary D. Waller. Vibrations of Free Elliptical Plates 451
Letters to the Editor:
Dr. D. K. C. MacDonald and Mr. J. E. Stanworth. Preparation of Alkali Metals in Glass 455
Mr. W. H. Shortt. The Dissipation of Energy by a Pendulum Oscillating in Air at Low Pressures 456
Reviews of Books 458
Contents for Section A 461
Abstracts for Section A 462

Part 7. *July* 1950

Prof. G. I. Finch. The Sliding Surface (34th Guthrie Lecture) 465
Mr. J. Crank. The Influence of Concentration-Dependent Diffusion on Rate of Evaporation 484
Mr. C. R. Barber. The E.M.F.–Temperature Calibration of Platinum, 10% Rhodium–Platinum and Platinum, 13% Rhodium–Platinum Thermocouples over the Temperature Range 0°–1,760° c. 492
Dr. J. Ashmead. A Joule–Thomson Cascade Liquefier for Helium 504
Dr. R. Street and Mr. J. C. Wolley. Time Decrease of Magnetic Permeability in Alnico 509
Prof. L. F. Bates and Mr. J. R. Mallard. The Magnetic Properties of Uranium and Uranium–Iron Alloys 520
Dr. E. H. Linfoot. On Phase-Contrast Testing with a Slit Source 527
Letters to the Editor:
Mr. P. C. Banbury and Dr. H. K. Henisch. On the Frequency Response of PbS Transistors 540
Reviews of Books 541
Contents for Section A 542
Abstracts for Section A 542

Part 8. *August* 1950

Prof. S. Tolansky and Mr. N. Barakat. New Localized Multiple-Beam Interference Fringes formed with Curved Thin Sheets 545
Mr. P. A. Wayman. The Monocentric Schmidt–Cassegrain Cameras . . . 553
Mr. A. E. J. Holtham and Mr. H. A. Prime. The Operation and Photographic Characteristics of a Kerr-cell Type of Electro-optical Shutter . . . 561
Mr. F. J. Bradshaw. The Optical Emissivity of Titanium and Zirconium . . 573
Dr. R. Bechmann. Determination of the Elastic and Piezoelectric Coefficients of Monoclinic Crystals, with particular Reference to Ethylene Diamine Tartrate . 577
Mr. N. W. Ramsey. Some Measurements of the Resistivity of Good Insulators . 590

PAGE

Mr. B. Milnes and Mr. R. S. Unwin. A Radio Meteorological Investigation in the South Island of New Zealand 595
Mr. C. C. Newton, Mr. F. J. Hyde and Mr. H. G. Foster. Ionospheric Cross-Modulation: Techniques of Measurement 616
Letters to the Editor:
Dr. R. Street and Mr. P. D. Whitaker. The Measurement of Microwave Power at Wavelengths of 3 cm. and 10 cm. 623
Dr. E. Schwarz. Photoconductive Cells of Cadmium Selenide . . . 624
Reviews of Books 626
Contents for Section A 629
Abstracts for Section A 630

Part 9. *September* 1950

Dr. J. B. Higham and Prof. J. M. Meek. Voltage Gradients in Long Gaseous Spark Channels 633
Dr. J. B. Higham and Prof. J. M. Meek. The Expansion of Gaseous Spark Channels 649
Dr. C. Dodd. The Electrical Resistance of Liquid Gallium in the Neighbourhood of its Melting Point 662
Mr. B. Collinge. Hydrogen-filled Geiger Counters 665
Dr. B. E. Noltingk and Mr. E. A. Neppiras. Cavitation produced by Ultrasonics. 674
Mr. H. G. W. Harding. The Colour Temperature of Light Sources . . 685
Dr. P. A. Lindsay. Certain Properties of Electrostatic Fields Encountered in Electron Lenses 699
Mr. U. F. Gianola. Reduction of the Spherical Aberration of Magnetic Electron Lenses 703
Mr. W. Weinstein. The Computation of Wave-Front Aberrations of Oblique Pencils in a Symmetrical Optical System 709
Letters to the Editor:
Mr. E. O. Hall. An Optical Method for Studying the Deformation of Mild Steel 724
Mr. S. N. Denno, Mr. H. A. Prime and Dr. J. D. Craggs. The Scattering of 3-cm. Radiation by Ionized Gases 726
Mr. W. R. Loosemore and Dr. Denis Taylor. Temperature Dependence of Counter Characteristics in Self-Quenching Geiger–Müller Counters . 728
Reviews of Books 730
Contents for Section A 734
Abstracts for Section A 734

Part 10. *October* 1950

Dr. H. H. Hopkins and Mr. P. M. Barham. The Influence of the Condenser on Microscopic Resolution 737
Dr. H. Kuhn and Mr. B. A. Wilson. Reflectivity of Thin Silver Films and their Use in Interferometry 745
Dr. A. F. Gibson. The Absorption Spectra of Solid Lead Sulphide, Selenide and Telluride 756
Dr. M. S. B. Chaghtai. Note on the Electron Velocity Distribution in Low Voltage Arcs 768
Mr. M. R. Hopkins and Mr. T. C. Toye. The Determination of the Viscosity of Molten Metals 773
Dr. R. Millership and Mr. F. V. Webster. High Frequency Permeability of Ferromagnetic Materials 783
Mr. K. S. W. Champion. The Production of Pulsed Magnetic Fields using Condenser Energy Storage 795
Dr. G. G. Macfarlane. A Theory of Contact Noise in Semiconductors . . 807
Dr. C. Dodd and Mr. G. N. Roberts. Dielectric Loss and Dielectric Constant Measurements in Supercooled Liquids 814

PAGE

Letters to the Editor :
Mr. P. D. Lomer. The Dielectric Strength of Aluminium Oxide Films . 818
Mr. G. D. Adam and Dr. K. J. Standley. Ferromagnetic Resonance in Manganese Arsenide 820
Mr. J. T. Kendall. Electrical Conductivity of Gray Tin 821
Mr. G. Francis and Dr. A. von Engel. Development of the Low Pressure Electrodeless Discharge in a High-Frequency Electric Field . . . 823
Reviews of Books 824
Contents for Section A 830
Abstracts for Section A 831

Part 11. *November* 1950

Dr. H. R. Thirsk. A Note on the Orientated Overgrowths of Metal Films on Single Crystal Inorganic Substrates 833
Dr. D. J. Phillips and Dr. N. Thompson. Surface Effects in Creep of Cadmium Crystals 839
Dr. M. Davis and Dr. N. Thompson. Creep in a Precipitation-Hardened Alloy . 847
Dr. H. K. Henisch and Mr. J. Ewels. A Study of Electrical Forming Phenomena at Selenium Contacts 861
Dr. D. Greene. Secondary Electron Emission from Molybdenum produced by Helium, Neon, Argon and Hydrogen 876
Mr. A. C. Lynch. The Variation with Temperature of the Piezoelectric Coefficients of Quartz 890
Mr. I. G. Ross and Dr. R. A. Sack. Solvent Effects in Dipole Moment Measurements 893
Mr. B. H. Briggs and Mr. G. J. Phillips. A Study of the Horizontal Irregularities of the Ionosphere 907
Dr. S. R. Khastgir and Mr. P. M. Das. Periodic Fading of Short-Wave Radio Signals 924
Dr. J. McG. Bruckshaw and Dr. B. S. Rao. Magnetic Hysteresis of Igneous Rocks 931
Mr. W. Culshaw. The Michelson Interferometer at Millimetre Wavelengths . 939
Mr. P. A. Sturrock. Note on the Focusing of Electron Beams in certain Magnetic Fields 954
Dr. J. F. W. Bell. Satellite Resonances in Ultrasonic Interferometry . . 958
Letters to the Editor :
Dr. J. R. Bristow: Dr. R. C. Parker and Mr. D. Hatch. Frictional Relaxation Oscillations 964
Contents for Section A 965
Abstracts for Section A 966

Part 12. *December* 1950

Dr. P. Jacquinot. Quelques recherches sur les raies faibles dans les spectres optiques (Fifth Holweck Discourse) 969
Dr. M. R. A. Rao. Electron Microscopic Studies on Aqueous Sols . . . 980
Mr. T. S. Moss. Photoconductivity in Magnesium Antimonide Layers . . 982
Prof. E. N. da C. Andrade, Dr. R. F. Y. Randall and Mr. M. J. Makin. The Rehbinder Effect 990
Mr. R. Parker. A Study of the Magneto-Resistance of Silicon–Iron . . . 996
Dr. R. S. Tebble and Dr. W. D. Corner. Investigations on the Reversible Susceptibility of Ferromagnetics 1005
Dr. G. B. Walker. Congruent Space Charge Flow 1017
Mr. J. M. Daniels. A 100-Kilowatt Water-cooled Solenoid 1028
Letters to the Editor :
Mr. H. D. Keith. Precision Lattice-Parameter Measurements . . . 1034
Mr. R. E. Burgess. The Capacitance of Selenium Rectifiers . . . 1036

PAGE

Mr. U. F. Gianola. The Correction of the Spherical Aberration of Electron Lenses using a Correcting Foil Element 1037
Mr. J. Paton. Aurora and Luminous Night Clouds 1039
Mr. F. V. Webster and Mr. K. S. Driver. High Frequency Permeability of Ferromagnetic Materials 1040
Obituary Notices :
James Reginald Ashworth 1041
Alfred Joseph Bull 1041
Frederick Charles Clarke 1042
James Arnold Crowther 1043
Geoffrey E. F. Fertel 1044
Cyril Owen Green 1045
Herman Shaw 1046
George William Todd 1047
Alexander Wood 1048
Contents for Section A 1051
Abstracts for Section A 1051
Subject Index, Section B, Vol. **63** 1053
Index of Authors (with Titles), Section B, Vol. **63** 1057
Index to Reviews of Books, Section B, Vol. **63** 1062